REMARKS/ARGUMENTS

Upon entry of this amendment, which amends claims 1, 22 and 23 and adds claim 27, claims 1-23, 25 and 26 remain pending, and claim 27 is newly presented for examination. Support for all amended and new claims can be found in the specification, and no new matter has been added.

In the Office Action to which this paper is responsive, claims 1-2, 5-7, 10-12, 22, 24 and 25 were rejected under 35 U.S.C. §103(a) as being unpatentable over Kikuta et al., U.S. Patent No. 6,260,131 ("Kikuta") in view of Carter et al., U.S. Patent No. 6,003,123 ("Carter") and Kong, U.S. Patent No. 5,465,337 ("Kong"). Claims 3, 4 and 9 were rejected under 35 U.S.C. §103(a) as being unpatentable over Kikuta in view of Carter and Kong and further in view of Sheets et al., U.S. Patent App. Pub. No. 2005/0044340 ("Sheets"). Claims 8 and 23 were rejected under 35 U.S.C. §103(a) as being unpatentable over Kikuta in view of Carter and Kong and further in view of Bungion et al., U.S. Patent No. 6,075,938 ("Bungion"). Claim 13 was rejected under 35 U.S.C. §103(a) as being unpatentable over Kikuta in view of Carter and Kong and further in view of Heaslip et al., U.S. Patent No. 5,930,832 ("Heaslip"). Claims 14-19 were rejected under 35 U.S.C. §103(a) as being unpatentable over Kikuta in view of Carter and Kong and further in view of Nielsen et al., U.S. Patent No. 6,104,417 ("Nielsen"). Claims 20, 21 and 26 were rejected under 35 U.S.C. §103(a) as being unpatentable over Kikuta in view of Carter and Kong and further in view of Vishin et al., U.S. Patent No. 5,860,146 ("Vishin").

Reconsideration in view of the foregoing amendments and following remarks is respectfully requested.

Rejection of Claims 1-2, 5-7, 10-12, 22, 24 and 25 under 35 U.S.C. §103(a)

Claims 1-2, 5-7, 10-12, 22, 24 and 25 were rejected under 35 U.S.C. §103(a) as being unpatentable over Kikuta in view of Carter and Kong. (Applicants note that claim 24 was previously canceled, so any rejection as to claim 24 is moot.) Without conceding the merits of the rejection as applied to the previously presented claims, Applicants respectfully submit that the amended claims overcome this rejection as to the remaining claims.

Independent claim 1 has been amended to recite that "each cluster includes a plurality of references to blocks of physical addresses such that the virtual addresses in the range mapped by the cluster are mapped to the blocks of physical addresses." By way of example, clusters including four references to blocks of physical addresses are shown in Fig. 4A of the application as filed, and clusters including eight references to blocks of physical addresses are shown in Fig. 4B; paragraphs [0069]-[0085] describe these example cluster structures.

A cluster that stores a plurality of references to blocks of physical memory is not taught or suggested by Kikuta, Carter or Kong. Kikuta is directed to a system for enforcing ordering constraints in a computer that allows at least some memory requests to be processed out of order (see Kikuta, Abstract). With regard to virtual-to-physical address mapping, Kikuta describes a conventional page table: "The page table contains a virtual page number that correlates each page of memory currently in main memory to a corresponding page in the swap space." (Kikuta, col. 3, lines 25-28.) In other words, a page table entry (PTE) maps one virtual page to one physical page. Kikuta also teaches a translation lookaside buffer (TLB) entry, shown in Fig. 4, that includes "a physical address field 141, an virtual address field 142," and various control fields. (Kikuta, col. 9, lines 1-4.) Kikuta states that the physical address field includes a page frame number while the virtual address field includes a virtual page number. (Kikuta, col. 9, lines 5-6.) Thus, a TLB entry maps one page of virtual address space to one physical page; like the page table entry, the TLB entry does not include "a plurality of references to blocks of physical addresses."

Carter teaches a system for global addressing across multiple processors using a shared virtual memory space. Each processor, or "node," has a local TLB (LTLB) that translates virtual addresses corresponding to physical memory maintained by that node. There is also a global TLB (GTLB) that is used to determine which node can translate a given virtual address. (See Carter, col. 17, lines 32-40.) An LTLB entry format is shown in Fig. 9. In this entry, a "virtual page is identified by the first 42 bits of the 54-bit virtual address," and "20 bits are sufficient to identify the physical page location (Carter, col. 15, lines 48-52.) Thus, the LTLB entry maps one virtual page to one physical page and does not include "a plurality of references to blocks of physical addresses" as claim 1 recites.

A GTLB entry format is shown in Fig. 13. The entry stores a virtual page identifier and a start node for a "sub-cube of nodes that the page-group maps across." (Carter, col. 17, lines 62-67). Thus, the GTLB entry does not include *any* references to blocks of physical addresses, let alone a plurality of such references, as claim 1 recites.

Kong teaches a TLB that supports variable-size pages. Kong shows, in Fig. 1, a conventional TLB entry with one fixed-size virtual page mapped to one physical page. (See Kong, col. 4, lines 45-49.) Kong also shows, in Fig. 3, a TLB that supports variable-size pages, but each TLB entry includes a reference to only *one* physical address (see Kong, col. 6, lines 51-55), not "a plurality of references to blocks of physical addresses," as claim 1 recites.

Thus, Kikuta, Carter and Kong, even in combination, fail to teach an address translation system using a cluster that includes "a *plurality* of references to blocks of physical addresses" as claim 1 recites.

For at least this reason, claim 1 is patentable over the cited references. Further, claims 2, 5-7, and 10-12 depend from claim 1 and derive patentability therefrom.

Independent claim 22, like claim 1, has been amended to recite that "each cluster includes a plurality of references to blocks of physical addresses such that the virtual addresses in the range mapped by the cluster are mapped to the blocks of physical addresses." Thus, claim 22 is patentable over the combination of Kikuta, Carter and Kong for the same reasons stated above with regard to claim 1. Further, dependent claim 25 depends from claim 22 and derive patentability therefrom.

In view of the foregoing, withdrawal of the rejection of claims 1-2, 5-7, 10-12, 22 and 25 under 35 U.S.C. §103(a) is respectfully requested.

Rejection of Claims 3, 4 and 9 under 35 U.S.C. §103(a)

Claims 3, 4 and 9 were rejected under 35 U.S.C. §103(a) as being unpatentable over Kikuta in view of Carter and Kong and further in view of Sheets.

Claims 3, 4 and 9 depend directly or indirectly from claim 1, and the rejection of claims 3, 4 and 9 is premised on the assertion that the combination of Kikuta, Carter and Kong discloses the features recited in the parent claims while Sheets discloses the remaining features

of claims 3, 4 and 9. As discussed above, however, the combination of Kikuta, Carter and Kong does not disclose or suggest all features recited in the parents of any of claims 3, 4 or 9. As best understood, Sheets provides no teaching or suggestion that would remedy this deficiency. The only disclosure found in Sheets that relates to address translation refers to a remote translation table (RTT) entry that contains "a 12-bit value representing PA35...24 (the 16 MB physical page frame)." (Sheets, para. [0043].) This suggests that the RTT entry maps a virtual page to one physical page.

Accordingly, Applicants respectfully request withdrawal of the rejection of claims 3, 4 and 9.

Rejection of Claims 8 and 23 under 35 U.S.C. §103(a)

Claims 8 and 23 were rejected under 35 U.S.C. §103(a) as being unpatentable over Kikuta in view of Carter and Kong and further in view of Bungion.

Claim 8 depends from claim 7, and claim 23 depends from claim 22. The rejection of claims 8 and 23 is premised on the assertion that the combination of Kikuta, Carter and Kong discloses the features recited in claims 7 and 23 while Bungion discloses the remaining features of claims 8 and 23. As discussed above, however, the combination of Kikuta, Carter and Kong does not disclose or suggest all features recited in claim 7 or claim 22. As best understood, Bungion provides no teaching or suggestion that would remedy this deficiency, since no disclosure related to TLB or page table entry formats could be found therein. It should be noted that Fig. 2 of Bungion teaches a mapping from a physical page to two replica machine pages (i.e., local copies of the same page), not a mapping from a range of virtual addresses to multiple blocks of physical memory (see Bungion, col. 7, lines 60-65; col. 13, lines 56-60).

Accordingly, Applicants respectfully request withdrawal of the rejection of claims 8 and 23.

Rejection of Claim 13 under 35 U.S.C. §103(a)

Claim 13 was rejected under 35 U.S.C. §103(a) as being unpatentable over Kikuta in view of Carter and Kong and further in view of Heaslip.

Claim 13 depends from claim 12, and the rejection of claim 13 is premised on the assertion that the combination of Kikuta, Carter and Kong discloses the features recited in claim 12 while Heaslip discloses the remaining features of claim 13. As discussed above, however, the combination of Kikuta, Carter and Kong does not disclose or suggest all features recited in claim 12. As best understood, Heaslip provides no teaching or suggestion that would remedy this deficiency, since no disclosure related to PTE or TLB entry formats could be found therein. Therefore, the rejection is based on a flawed premise and cannot be maintained. Accordingly, Applicants respectfully request withdrawal of the rejection of claim 7.

Rejection of Claims 14-19 under 35 U.S.C. §103(a)

Claims 14-19 were rejected under 35 U.S.C. §103(a) as being unpatentable over Kikuta in view of Carter and Kong and further in view of Nielsen.

Claims 14-19 each depend directly or indirectly from claim 1, and the rejection of claims 14-19 is premised on the assertion that the combination of Kikuta, Carter and Kong discloses the features recited in the parent claims while Nielsen discloses the remaining features of each of claims 14-19. As discussed above, however, the combination of Kikuta, Carter and Kong does not disclose or suggest all features recited in claim 1, let alone the other claims from which claims 14-19 depend. As best understood, Nielsen provides no teaching or suggestion that would remedy this deficiency, as there could not be found in Nielson any disclosure related to TLB entry formats. Accordingly, Applicants respectfully request withdrawal of the rejection of claims 14-19.

Rejection of Claims 20, 21 and 26 under 35 U.S.C. §103(a)

Claims 20, 21 and 26 were rejected under 35 U.S.C. §103(a) as being unpatentable over Kikuta in view of Carter and Kong and further in view of Vishin.

Claims 20 and 21 depend from claim 1, while claim 26 depends from claim 22. The rejection of claims 20, 21 and 26 is premised on the assertion that the combination of Kikuta, Carter and Kong discloses the features recited in claims 1 and 22 while Vishin discloses the remaining features of claims 20, 21 and 26. As discussed above, however, the combination of Kikuta, Carter and Kong does not disclose or suggest all features recited in claims 1 and 22.

As best understood, Vishin provides no teaching or suggestion that would remedy this deficiency, as Vishin teaches only one-to-one mappings of virtual pages to physical pages.

Accordingly, Applicants respectfully request withdrawal of the rejection of claims 20, 21 and 26.

New Claim 27

Claim 27 has been added by this amendment. Applicants respectfully submit that support for this claim may be found in the specification. It should also be noted that claim 27 is substantively identical to previously canceled claim 24.

In order to expedite prosecution, Applicants respectfully submit that claim 27 is patentable over the cited art by virtue of its dependence from claim 22, which is patentable for reasons stated above.

CONCLUSION

In view of the foregoing, Applicants believe all claims now pending in this Application are in condition for allowance. The issuance of a formal Notice of Allowance at an early date is respectfully requested.

If the Examiner believes a telephone conference would expedite prosecution of this application, please telephone the undersigned at 650-326-2400.

Respectfully submitted,

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